

GUATEMALA

**PLAN PUEBLA-PANAMA
GUATEMALA-MEXICO ELECTRICITY
INTERCONNECTION PROJECT**

(GU-0171)

LOAN PROPOSAL

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BASIC SOCIOECONOMIC DATA

For basic socioeconomic data, including public debt information, please refer to the following address:

<http://www.iadb.org/RES/index.cfm?fuseaction=externallinks.countrydata>

ABBREVIATIONS

AMM	Wholesale market manager
ATC	Annual transmission cost
CENACE	National Energy Control Center (attached to CFE)
CFE	Federal Electricity Commission
CNEE	National Electric Power Commission
CRE	Energy Regulation Commission
CRIE	Regional Electric Power Interconnection Commission
DEOCSA	Distribuidora de Electricidad de Occidente, S.A.
DEORSA	Distribuidora de Electricidad de Oriente, S.A.
DVA	Distribution value-added
ECOE	Empresa de Comercialización de Energía
EEGSA	Guatemalan Electric Power Company [Empresa Eléctrica de Guatemala]
ETIAS	Environmental and Social Impact Study
EOR	Regional operating entity
EPR	Network proprietor firm
ETCEE	Empresa de Transporte y Control de Energía Eléctrica
GEF	Global Environmental Facility
ICB	International competitive bidding
INDE	National Electrification Institute
JSF	Japan Special Fund
LCB	Local competitive bidding
LGE	General Electricity Act
MARN	Ministry of the Environment and Natural Resources
MEM	Ministry of Energy and Mining
MER	Regional electricity market
PB	Private bidding
PER	Rural Electrification Program
PGAS	Environmental and Social Management Plan
PPA	Power purchase agreement
PPP	Puebla-Panama Plan
SBP	Strategic business plan
SEA	Strategic Environmental Assessment
SEN	National Electricity System
SENER	Ministry of Energy (Mexico)
SHCP	Ministry of Finance and Public Credit (Mexico)
SIEPAC	Central American Electric Power Interconnection System
SIN	National Grid [Sistema Nacional Interconectado]
UA	Environmental unit



GUATEMALA

IDB LOANS

APPROVED AS OF MAY 31, 2003

	US\$Thousand	Percent
TOTAL APPROVED	2,587,123	
DISBURSED	2,029,605	78.45 %
UNDISBURSED BALANCE	557,519	21.54 %
CANCELATIONS	256,147	9.90 %
PRINCIPAL COLLECTED	816,157	31.54 %
APPROVED BY FUND		
ORDINARY CAPITAL	1,881,508	72.72 %
FUND FOR SPECIAL OPERATIONS	632,137	24.43 %
OTHER FUNDS	73,477	2.84 %
OUTSTANDING DEBT BALANCE	1,213,448	
ORDINARY CAPITAL	816,754	67.30 %
FUND FOR SPECIAL OPERATIONS	390,630	32.19 %
OTHER FUNDS	6,064	0.49 %
APPROVED BY SECTOR		
AGRICULTURE AND FISHERY	185,369	7.16 %
INDUSTRY, TOURISM, SCIENCE AND TECHNOLOGY	222,862	8.61 %
ENERGY	357,878	13.83 %
TRANSPORTATION AND COMMUNICATIONS	440,390	17.02 %
EDUCATION	65,628	2.53 %
HEALTH AND SANITATION	303,291	11.72 %
ENVIRONMENT	64,300	2.48 %
URBAN DEVELOPMENT	227,796	8.80 %
SOCIAL INVESTMENT AND MICROENTERPRISE	250,772	9.69 %
REFORM AND PUBLIC SECTOR MODERNIZATION	467,074	18.05 %
EXPORT FINANCING	1,764	0.06 %
PREINVESTMENT AND OTHER	0	0.00 %

* Net of cancellations with monetary adjustments and export financing loan collections.



Inter-American Development Bank
Regional Operations Support Office
Operational Information Unit

Guatemala

Tentative Lending Program

2003

Project Number	Project Name	IDB US\$ Millions	Status
GU0170	Housing / Population Census	25.0	APPROVED
GU0150	Rural Water Investment Program	50.0	
GU0171	Electric Interconnection between Guatemala and Mexico	37.5	
Total - A : 3 Projects		112.5	
GU0126	Rural Electrification Program	91.0	
Total - B : 1 Projects		91.0	
TOTAL 2003 : 4 Projects		203.5	

2004

Project Number	Project Name	IDB US\$ Millions	Status
GU0143	Modernization of National Congress	12.0	
GU0154	Microcredit Global Program	15.0	
Total - A : 2 Projects		27.0	
GU0173	Local Development and Reconciliation	52.0	
GU0164	National System for Services and Goods Contr.	6.8	
GU0176	Turism for Mundo Maya Circuit	40.0	
GU0157	Pov. Red. Strat Implementation	30.0	
GU0066	Sanitation & Sust.management Amatitlan Basin	21.0	
GU0153	Housing Program	20.0	
GU0163	Citizen Security	30.0	
GU0165	Electoral Supreme Tribunal Modernization	15.0	
GU0177	Justice Program	24.0	
GU0178	Modernization and Strengthening of Comptrollers Office	19.0	
Total - B : 10 Projects		257.8	
TOTAL - 2004 : 12 Projects		284.8	

Total Private Sector 2003 - 2004	0.0
Total Regular Program 2003 - 2004	488.3

* Private Sector Project



GUATEMALA

STATUS OF LOANS IN EXECUTION

AS OF MAY 31, 2003

(Amount in US\$ thousands)

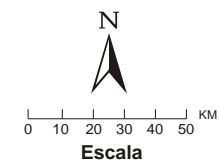
APPROVAL PERIOD	NUMBER OF PROYECTS	AMOUNT APPROVED*	AMOUNT DISBURSED	% DISBURSED
<u>REGULAR PROGRAM</u>				
Before 1997	3	51,600	37,321	72.33 %
1997 - 1998	8	279,010	201,215	72.12 %
1999 - 2000	4	235,672	74,053	31.42 %
2001 - 2002	10	373,337	120,846	32.37 %
2003	1	25,000	0	0.00 %
<u>PRIVATE SECTOR</u>				
2001 - 2002	1	25,000	0	0.00 %
TOTAL	27	\$989,619	\$433,435	43.80 %

* Net of cancellations. Excludes export financing loans.



GUATEMALA

Sistema de Transmision Electrico (GU-0171)



SIMBOLOGIA

- Planta
- Subestación existente
- Subestación Proyectada
- Subestación a Modificar
- Linea de 138 kV
- Linea de 230 kV
- == Linea de 230 kV Doble Circuito
- Linea de Transmisión Proyectada
 - INDE Proyecto (BID)
 - CFE Proyecto
 - Proyecto SIEPAC (230 kV)
 - Linea de 230 kV
 - Linea de 138 kV

PLAN PUEBLA-PANAMA
GUATEMALA - MEXICO ELECTRICITY INTERCONNECTION PROJECT
(GU-0171)

EXECUTIVE SUMMARY

Borrower:	Republic of Guatemala				
Executing agency:	National Electrification Institute	[Instituto Nacional de Electrificación]	(INDE)		
Amount and source:	IDB: (OC)	US\$37.50 million			
	Local:	US\$ 5.79 million			
	Total::	US\$43.29 million			
Financial terms and conditions:	Amortization period:	25 years			
	Grace period:	4 years			
	Disbursement period:	4 years maximum			
		3 years minimum			
	Interest rate:	variable			
	Inspection and supervision:	1%			
	Credit fee:	0.75%			
	Currency:	US dollars drawn from the Single Currency Facility. Variable interest rate			
Objectives:	The general objective of the project is to increase energy supply in Guatemala, improve prices and enhance the security and quality of the electricity service. The project's specific objectives are as follows: (i) to interconnect Guatemala's electric power system with that of Mexico; (ii) to interconnect the Mexican system with the Central American Electric Power Interconnection System (SIEPAC), through the interconnection that already exists between Guatemala and the other five Central American countries; and (iii) to establish accords and define rules to permit and promote energy exchange between agents in Mexico and Guatemala, and in other countries through Guatemala.				
Description:	The Guatemala-Mexico interconnection involves construction of a 103-km, 400kV electric power transmission line, and expansion of two substations—one in Tapachula (Mexico) and the other in Los Brillantes, Retalhuleu (Guatemala). The initial capacity of the interconnection is expected to be 200MW from Mexico to Guatemala				

and 70MW in the opposite direction. The project in Mexico requires construction of 32 km of transmission line at 400kV, and execution of civil and electromechanical works to expand the Tapachula substation as needed to connect the new line to the Mexican system. The Mexican part of the project will be financed with resources from the Federal Electricity Commission (CFE). To date, the CFE has secured financing for the works in its approved budget and has acquired all the materials needed for construction of the power line. The Bank loan will finance the Guatemala portion, which has been divided into three components: (i) construction of the transmission line; (ii) upgrading of the Los Brillantes substation; and (iii) supervision of works and assembly. As an integral part of the project, a legal structure has been designed to ensure binational coordination during the construction and operation phases. This contains the elements needed to afford legal security and promote commercial energy transactions between the two countries (see paragraphs 2.11 to 2.18).

The Bank's country and sector strategy:

As part of the Puebla-Panama Plan (PPP), the interconnection project is consistent with Bank policies in promoting projects of multinational scope that speed up the regional integration process (OP-702); it is also consistent with the Bank's country strategy, which accords special importance to sustainable economic growth and competitiveness, and prioritizes poverty reduction. As the project will help reduce energy prices and enhance the security of the electric power system, Guatemalan industry will become more competitive and there will be greater potential for future social electrification projects. The project is also in line with policies to facilitate medium-term financing for intra-regional exports of capital goods and services, in order to promote integration and economic development in the region, and expand and diversify its trade.

Coordination with other agencies:

The Bank and the government, acting through the Puebla-Panama Plan Promotion and Financing Commission, have submitted the project and carried out coordination activities with other agencies, including the World Bank, the Central American Bank for Economic Integration (CABEI), the Japanese Bank for International Cooperation, KFW (Germany) and the Economic Development Cooperation Fund (Korea). In addition, the Mexican and Guatemalan governments have analyzed funding for the project in the framework of the San José Accord (see paragraph 1.53).

Environmental and social review:

Electric power transmission works can have major environmental and social impacts. In compliance with current regulations for projects to construct power transmission lines above 230kV, an Environmental and Social Impact Study (EIAS) was performed. This made it possible to identify potential environmental and social impacts, both direct and indirect, along with potential environmental liabilities. The EIAS also

evaluated the institutional framework for environmental and social management, defined activities and methodology directly related to the management and mitigation of those impacts, and drew up a suitable execution scheme for the program's environmental management. An Environmental and Social Management Plan (PGAS) has also been prepared for the project, drawing on lessons learned from the executed portion of loan GU-0126 (Rural Electrification Program—PER).

Benefits and development impact:

The benefits of the Guatemala-Mexico interconnection include greater competition, lower energy costs and an increase in available capacity. Among other things, this will increase the potential to carry out social electrification projects in the future, make the current Guatemalan electric power system more secure, and help ensure that the benefits have regional impact in the medium-term. Social electrification projects contribute to local economic development among the affected populations, and they create capacity for better opportunities in areas such as education or health by providing a stable electric power system. The interconnection also allows new players to enter the market, thereby increasing competition and reducing potential domination by incumbents and control of the regulatory agency by the regulated industry. A downward trend in electric power costs improves the sustainability of the electricity system, reduces fiscal requirements for the sector and opens up new spaces for social investment. In addition, by tying Guatemala into a relatively large system, transmission frequency will suffer fewer fluctuations, so users will enjoy a better quality service. In addition to benefiting residential users, this also generates productivity improvements among commercial and industrial customers that use specialized electrical equipment.

Risks:

There are a number of specific situations that could affect outcomes and impacts during the course of the project. In the case of outcomes, the main risks are as follows: (i) potential situations arising inside each country that could delay the project during the construction phase; and (ii) considering that the interconnection would be the first 400 kV power line in Guatemala, there is scant operational and technical experience in INDE to execute and operate a project for transmission at this voltage. With regard to impacts, the greatest risk would result from the interconnection being underused in the operating stage. Coordination or communication problems between the two countries could restrict the amount of energy carried by the interconnection, thereby affecting its economic viability; and periods of shortages in the Mexican or Guatemala markets could lower the priority of energy dispatch for export to either country.

To mitigate potential coordination and communication risks, the authorities and the Bank held intensive consultations with project stakeholders in the early stages of preparation. Based on the information thus obtained and on the specifics of the project, a legally enforceable juridical structure has been designed, based on a Memorandum of Understanding signed between the two countries and binational agreements laying the foundations for execution and commercial operation of the interconnection (paragraphs 2.11 through 2.18). The prior consultation work has also been a major facilitator in building consensus around the project in the two countries.

The lack of experience in INDE with 400kV transmission lines has been overcome through permanent technical support from the CFE, in carrying out electrical studies, designing the line and preparing bidding documents, which are at an advanced stage of preparation. In addition, independent works supervisors will be hired as part of the operation to ensure compliance with the documents. During the operation, this risk will be mitigated through the coordination between INDE and the CFE established under the operation and maintenance agreement.

**Special
contractual
clauses:**

A. Conditions precedent to the first disbursement:

The loan executing agency will submit evidence to the Bank that the binational working group responsible for arrangements to facilitate commercialization of the power line services is functioning (paragraph 2.17).

Presentation of the subsidiary agreement signed between the borrower and INDE for the transfer of loan proceeds to INDE, and establishing INDE's obligations as project executing agency (paragraph 3.1).

B. Other special contractual conditions:

The borrower, the executing agency and the Bank will hold annual meetings to analyze progress in project implementation. These will be based on six-monthly reports prepared by the executing agency (paragraphs 3.10 and 3.11) and technical audits prepared by the firm hired to produce the project's annual financial statements (paragraph 3.12).

With reference to article 6.01 of the General Conditions, the contract will stipulate that any modification to the legal instruments comprising the project's juridical framework, as described in paragraph 2.11 through 2.18, will require a statement of nonobjection from the Bank.

The loan contract will also include standard Bank conditions relating to technical and environmental aspects, auditing, reports, inspections, evaluations, maintenance, contracting for consulting services and goods procurement, among other issues.

Retroactive financing and recognition of expenses:

Up to US\$250,000 in expenses incurred as of 1 July 2002 will be recognized retroactively as part of the counterpart funding. Retroactive recognition will: (i) cover expenses incurred in preparing bidding documents, studies for establishing the cadastre and services hired to obtain rights of way; and (ii) be conditional upon compliance with substantially analogous requirements to those established in the eventual loan contract.

Poverty-targeting and social sector classification:

The operation does not qualify either as a social-equity enhancing project, as described in the key objectives for Bank activity set forth in the Report on the Eighth General Increase in Resources (document AB-1704), or as a poverty-targeted investment (see paragraph 4.26).

Exceptions to Bank policy:

None.

Procurement:

In view of the complexity involved in coordinating the civil works, assembly and equipment procurement, turnkey contracts will be used for the power line and substation (paragraph 3.6).

INDE has requested a waiver from the Bank to allow direct purchase, by reference to brand and model, of telecommunications protection, measurement and SCADA equipment at the Los Brillantes substation, in order to ensure compatibility with the equipment used in the Mexican system (paragraph 3.7).

Before the necessary rights of way have all been obtained, the executing agency will be able to convene international competitive bidding for the project's civil works. Nonetheless, this will be on the understanding that prior to signing the contract for civil works construction, proof will be provided to the Bank of legal ownership of property, rights of way or other rights needed to start the works (paragraphs 3.3 through 3.5).

Project procurements will require international competitive bidding (ICB) in the following cases: civil works contracts in excess of US\$1.5 million; consulting services for more than US\$200,000; and goods procurement for amounts above US\$250,000. When the contract amounts are below these limits, procurement will be governed in principle by local legislation (see paragraph 3.8).

and 70MW in the opposite direction. The project in Mexico requires construction of 32 km of transmission line at 400kV, and execution of civil and electromechanical works to expand the Tapachula substation as needed to connect the new line to the Mexican system. The Mexican part of the project will be financed with resources from the Federal Electricity Commission (CFE). To date, the CFE has secured financing for the works in its approved budget and has acquired all the materials needed for construction of the power line. The Bank loan will finance the Guatemala portion, which has been divided into three components: (i) construction of the transmission line; (ii) upgrading of the Los Brillantes substation; and (iii) supervision of works and assembly. As an integral part of the project, a legal structure has been designed to ensure binational coordination during the construction and operation phases. This contains the elements needed to afford legal security and promote commercial energy transactions between the two countries (see paragraphs 2.11 to 2.18).

The Bank's country and sector strategy:

As part of the Puebla-Panama Plan (PPP), the interconnection project is consistent with Bank policies in promoting projects of multinational scope that speed up the regional integration process (OP-702); it is also consistent with the Bank's country strategy, which accords special importance to sustainable economic growth and competitiveness, and prioritizes poverty reduction. As the project will help reduce energy prices and enhance the security of the electric power system, Guatemalan industry will become more competitive and there will be greater potential for future social electrification projects. The project is also in line with policies to facilitate medium-term financing for intra-regional exports of capital goods and services, in order to promote integration and economic development in the region, and expand and diversify its trade.

Coordination with other agencies:

The Bank and the government, acting through the Puebla-Panama Plan Promotion and Financing Commission, have submitted the project and carried out coordination activities with other agencies, including the World Bank, the Central American Bank for Economic Integration (CABEI), the Japanese Bank for International Cooperation, KFW (Germany) and the Economic Development Cooperation Fund (Korea). In addition, the Mexican and Guatemalan governments have analyzed funding for the project in the framework of the San José Accord (see paragraph 1.53).

Environmental and social review:

Electric power transmission works can have major environmental and social impacts. In compliance with current regulations for projects to construct power transmission lines above 230kV, an Environmental and Social Impact Study (EIAS) was performed. This made it possible to identify potential environmental and social impacts, both direct and indirect, along with potential environmental liabilities. The EIAS also

evaluated the institutional framework for environmental and social management, defined activities and methodology directly related to the management and mitigation of those impacts, and drew up a suitable execution scheme for the program's environmental management. An Environmental and Social Management Plan (PGAS) has also been prepared for the project, drawing on lessons learned from the executed portion of loan GU-0126 (Rural Electrification Program—PER).

Benefits and development impact:

The benefits of the Guatemala-Mexico interconnection include greater competition, lower energy costs and an increase in available capacity. Among other things, this will increase the potential to carry out social electrification projects in the future, make the current Guatemalan electric power system more secure, and help ensure that the benefits have regional impact in the medium-term. Social electrification projects contribute to local economic development among the affected populations, and they create capacity for better opportunities in areas such as education or health by providing a stable electric power system. The interconnection also allows new players to enter the market, thereby increasing competition and reducing potential domination by incumbents and control of the regulatory agency by the regulated industry. A downward trend in electric power costs improves the sustainability of the electricity system, reduces fiscal requirements for the sector and opens up new spaces for social investment. In addition, by tying Guatemala into a relatively large system, transmission frequency will suffer fewer fluctuations, so users will enjoy a better quality service. In addition to benefiting residential users, this also generates productivity improvements among commercial and industrial customers that use specialized electrical equipment.

Risks:

There are a number of specific situations that could affect outcomes and impacts during the course of the project. In the case of outcomes, the main risks are as follows: (i) potential situations arising inside each country that could delay the project during the construction phase; and (ii) considering that the interconnection would be the first 400 kV power line in Guatemala, there is scant operational and technical experience in INDE to execute and operate a project for transmission at this voltage. With regard to impacts, the greatest risk would result from the interconnection being underused in the operating stage. Coordination or communication problems between the two countries could restrict the amount of energy carried by the interconnection, thereby affecting its economic viability; and periods of shortages in the Mexican or Guatemala markets could lower the priority of energy dispatch for export to either country.

To mitigate potential coordination and communication risks, the authorities and the Bank held intensive consultations with project stakeholders in the early stages of preparation. Based on the information thus obtained and on the specifics of the project, a legally enforceable juridical structure has been designed, based on a Memorandum of Understanding signed between the two countries and binational agreements laying the foundations for execution and commercial operation of the interconnection (paragraphs 2.11 through 2.18). The prior consultation work has also been a major facilitator in building consensus around the project in the two countries.

The lack of experience in INDE with 400kV transmission lines has been overcome through permanent technical support from the CFE, in carrying out electrical studies, designing the line and preparing bidding documents, which are at an advanced stage of preparation. In addition, independent works supervisors will be hired as part of the operation to ensure compliance with the documents. During the operation, this risk will be mitigated through the coordination between INDE and the CFE established under the operation and maintenance agreement.

**Special
contractual
clauses:**

A. Conditions precedent to the first disbursement:

The loan executing agency will submit evidence to the Bank that the binational working group responsible for arrangements to facilitate commercialization of the power line services is functioning (paragraph 2.17).

Presentation of the subsidiary agreement signed between the borrower and INDE for the transfer of loan proceeds to INDE, and establishing INDE's obligations as project executing agency (paragraph 3.1).

B. Other special contractual conditions:

The borrower, the executing agency and the Bank will hold annual meetings to analyze progress in project implementation. These will be based on six-monthly reports prepared by the executing agency (paragraphs 3.10 and 3.11) and technical audits prepared by the firm hired to produce the project's annual financial statements (paragraph 3.12).

With reference to article 6.01 of the General Conditions, the contract will stipulate that any modification to the legal instruments comprising the project's juridical framework, as described in paragraph 2.11 through 2.18, will require a statement of nonobjection from the Bank.

The loan contract will also include standard Bank conditions relating to technical and environmental aspects, auditing, reports, inspections, evaluations, maintenance, contracting for consulting services and goods procurement, among other issues.

Retroactive financing and recognition of expenses:

Up to US\$250,000 in expenses incurred as of 1 July 2002 will be recognized retroactively as part of the counterpart funding. Retroactive recognition will: (i) cover expenses incurred in preparing bidding documents, studies for establishing the cadastre and services hired to obtain rights of way; and (ii) be conditional upon compliance with substantially analogous requirements to those established in the eventual loan contract.

Poverty-targeting and social sector classification:

The operation does not qualify either as a social-equity enhancing project, as described in the key objectives for Bank activity set forth in the Report on the Eighth General Increase in Resources (document AB-1704), or as a poverty-targeted investment (see paragraph 4.26).

Exceptions to Bank policy:

None.

Procurement:

In view of the complexity involved in coordinating the civil works, assembly and equipment procurement, turnkey contracts will be used for the power line and substation (paragraph 3.6).

INDE has requested a waiver from the Bank to allow direct purchase, by reference to brand and model, of telecommunications protection, measurement and SCADA equipment at the Los Brillantes substation, in order to ensure compatibility with the equipment used in the Mexican system (paragraph 3.7).

Before the necessary rights of way have all been obtained, the executing agency will be able to convene international competitive bidding for the project's civil works. Nonetheless, this will be on the understanding that prior to signing the contract for civil works construction, proof will be provided to the Bank of legal ownership of property, rights of way or other rights needed to start the works (paragraphs 3.3 through 3.5).

Project procurements will require international competitive bidding (ICB) in the following cases: civil works contracts in excess of US\$1.5 million; consulting services for more than US\$200,000; and goods procurement for amounts above US\$250,000. When the contract amounts are below these limits, procurement will be governed in principle by local legislation (see paragraph 3.8).

I. REFERENCE FRAMEWORK

A. The Puebla-Panama Plan

- 1.1 The Puebla-Panama Plan (PPP) was adopted in the Joint Declaration of the Extraordinary Summit of countries participating in the Tuxtla Dialog and Consensus Mechanism, held in El Salvador on 15 June 2001. The aim of the plan is to leverage the human and ecological wealth of the Mesoamerican region, within a framework of sustainable development. To this end, the PPP proposes a strategy that not only underpins Central American integration efforts, but also strengthens them by including the south-southeastern region of Mexico within the concept of Mesoamerica.
- 1.2 The PPP strategy consists of the following eight initiatives and their projects: (i) sustainable development; (ii) human development; (iii) prevention and mitigation of natural disasters; (iv) tourism promotion; (v) trade facilitation; (vi) highway integration; (vii) the Mesoamerican Energy Initiative; and (viii) integration of telecommunications services. The Energy Initiative includes three projects that aim to unify electric power markets, attract private participation, reduce the cost of electricity and enhance competitiveness. The first of these involves development of the Central American Electric Power Interconnection System (SIEPAC), which will physically integrate the electricity markets of Panama, Costa Rica, Nicaragua, Honduras, El Salvador and Guatemala. The second project will connect SIEPAC to the Mexican market by building an interconnection line between Guatemala and Mexico. Lastly, the initiative envisages tying Belize into the system, by constructing a power line between that country and Guatemala.
- 1.3 Political leadership of the PPP was delegated to an executive commission consisting of a high-level authority from each participating country. The plan's initiatives and projects are defined by this commission, and each commissioner currently coordinates one initiative. The energy initiative is being coordinated by the Commissioner for Guatemala. On 18 December 2001 an action plan was defined for the Mexico-Guatemala interconnection, and a binational working group was set up to carry out actions aimed at pushing the project forward. This is coordinated by Guatemala's National Electrification Institute (INDE) and Mexico's Federal Electricity Commission (CFE).
- 1.4 The Guatemala-Mexico interconnection project is also one of the objectives of the Energy Cooperation Accord signed between Mexico and Guatemala on 17 March 1997, which seeks to broaden cooperation and leverage the potential for energy complementation between the two countries.

B. The Guatemalan electric power sector

1. Institutional setting

a. Reform in the 1990s

- 1.5 In the mid-1990s, Guatemala embarked upon a strategy to modernize its electric power sector. This was based on: (i) implementation of the General Electricity Act (LGE) in late 1996; (ii) restructuring of the two State-owned electric power utilities; and (iii) privatization of distribution and a major part of the generating segment.
- 1.6 The LGE defined the Ministry of Energy and Mining (MEM) as the top authority of the energy sector in the country, ordered the National Electric Power Commission (CNEE) to be created, and provided for a private non-profit wholesale market administrator (AMM) to manage the wholesale energy market. The CNEE regulates prices relating to: (i) transfers of electric power and energy between generators, distributors, traders, importers and exporters that result from operating the national electricity system at lowest possible cost, when such transfers are not included in supply contracts freely agreed between the parties; (ii) the user charges for transport lines, transformer substations and distribution installations in cases where it has been impossible to establish these by free agreement between the parties; and (iii) power supplies to end users of the distribution service, whose maximum power demand is below 100kW. When the maximum power demand is higher than this, users are not subject to price regulation, and supply conditions are freely negotiated with the distributor or any other supplier. Other market prices are unregulated. The AMM, meanwhile, carries out short- and long-term programming functions, in addition to real-time coordination of execution and settlement of commercial transactions.
- 1.7 As part of the reform process, the Government of Guatemala restructured the two State-owned utilities: the Guatemalan Electric Power Company (EEGSA) and the National Electrification Institute (INDE). EEGSA distribution activities were separated from generation, and the INDE distribution segment was split into two enterprises covering the east and west of the country respectively: DEORSA (Distribuidora de Electricidad de Oriente, S.A.) y DEOCSA (Distribuidora de Electricidad de Occidente, S.A.). By selling 80% of the shares, the Guatemalan government privatized both the generation and distribution arms of EEGSA, together with the distribution firms resulting from INDE.¹

¹ The 80% ownership stake in the EEGSA distributor was acquired by a consortium consisting of Iberdrola (49%), TECO Power Services (TPS) (30%) and Electricidad de Portugal (21%); equivalent interests in DEOCSA and DEORSA were sold to Distribuidora Eléctrica del Caribe, S.A. (buyer), an enterprise set up and owned by Grupo Unión Fenosa (UF).

b. Organizational structure of INDE

- 1.8 When the General Electricity Act (LGE) entered into force, INDE was reorganized as a holding company with three subsidiary firms: Empresa de Generación de Energía Eléctrica (EGEE), Empresa de Transporte y Control de Energía Eléctrica (ETCEE) and Empresa de Comercialización de Energía (ECOE), responsible for the businesses of electric power generation, transport and marketing respectively. Other business functions such as finance, human resources, corporate services, rural electrification, and the legal, technical and internal audit departments operate under the mother company and are shared by the business units mentioned above. Accordingly, the three utilities are not actually fully autonomous and depend on the mother company for the allocation of resources, among other things. This situation is typical of the reform carried out in Guatemala (see paragraph 1.43).
- 1.9 ETCEE in turn has the following divisions: (i) Superintendency of Operations; (ii) Oversight; (iii) Planning and Engineering; and (iv) Financial Management. All of these are accountable to the ETCEE management, which in turn has legal and internal audit offices. The Superintendency of Operations consists of the eastern, western and central systems, each of which is responsible for operation and maintenance of the transport network. The Oversight Division is responsible for the load dispatch service provided to AMM, real-time operation of the system and electrical studies on the transport network. The Planning and Engineering Division is responsible for design and supervision of substations and transmission lines; preparation of terms of reference for tendering on civil and electromechanical works, equipment supply, and topographical work; and management of rights of way. Lastly, the Financial Management Division is responsible for budget, financial control, purchasing, administrative services and business management functions.

2. Structure of the market in Guatemala

- 1.10 Installed capacity in the National Grid (SIN) in 2002 amounted to 1,672MW, for a maximum demand of 1,075MW recorded in 2001. Total energy consumption was 5,456GWh in 2001, including losses of 11.8% in the transmission and distribution networks. Although sales growth between 1996 and 2000 averaged 10.5% per year, the rate fell to 4.2% in 2000-2001.
- 1.11 The resources of the system include the power plants of the State-owned generating utility EGEE, which are mainly hydraulic; private-sector hydroelectric plants that have standard power purchase agreements (PPAs) with the State firm INDE, private thermal power plants with PPAs with EEGSA, merchant plants (plantas mercantes), and an interconnection with El Salvador. EGEE owns the country's leading hydroelectric power plants, with an installed capacity of 479MW, producing 37% of total consumption in 2001. It also owns an old and inefficient thermal power plant which hardly generates any power. Private firms own a total of 1,050MW of installed capacity; 150MW was built as merchant plants, and the

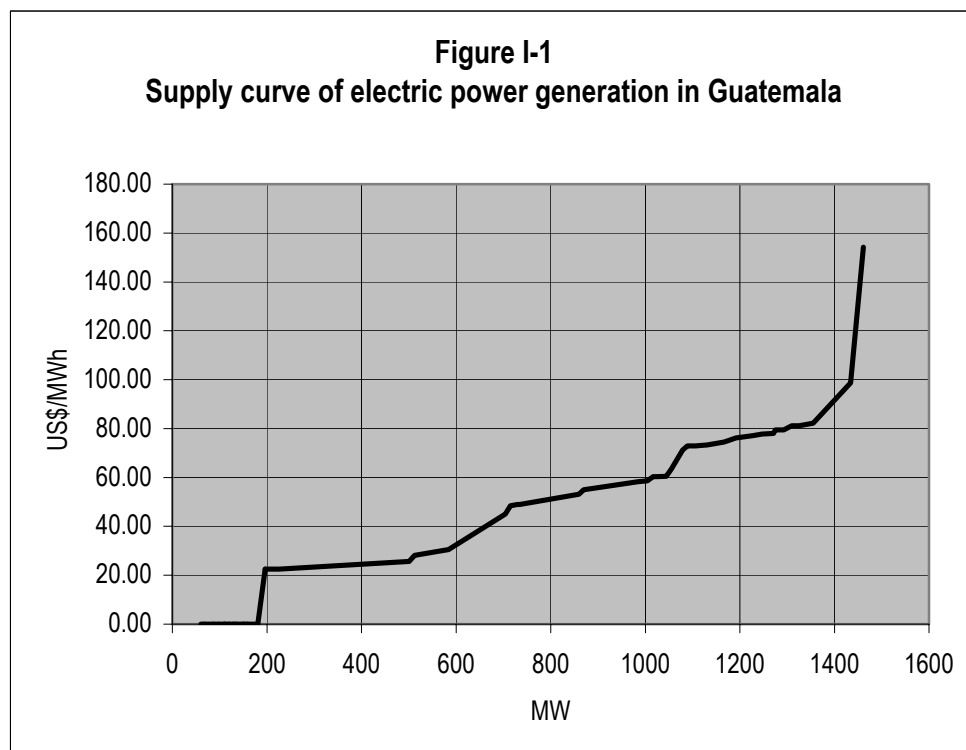
remainder have PPAs which were mostly signed before the reform, although one was signed as part of the privatization process. Approximately 650MW covered by PPAs is administered by EEGSA, and the remaining 80MW by INDE.

- 1.12 The transmission system is 90% State-owned and operated through ETCEE. The transport system has a 2,085 km-long network of which 647 km consists of power lines at 230kV, and 1,438 km between 138kV and 69kV. The network includes an interconnection with the El Salvador system. The topology of the transport network is quite radial, particularly at the 230kV level, which makes it weak. New generation capacity has been installed mainly on the Pacific coast, and there is insufficient transmission capacity to meet typical safety criteria (for example, “n-1”). The fact that there is a single 230kV line running between the Los Brillantes substation and the metropolitan area, which is the country’s main load center, restricts capacity for transfer from the interconnection to be financed.
- 1.13 A strong transmission system is needed to develop the electric power market in Guatemala and maximize the potential benefits of integration with Central American markets through SIEPAC and the proposed interconnection. Appropriate incentives are needed for this, and requirements for transmission strengthening need to be identified in order to overcome the constraints in the system. Work is currently being done on the strengthening plan in relation to SIEPAC requirements and in the framework of the GU-0126 operation, currently under preparation. This includes elements of institutional strengthening that will also help design tariff incentives to promote investments in power transmission (paragraph 1.41).
- 1.14 Distribution is carried out by the firms EEGSA, DEORSA and DEOCSA. The EEGSA distribution area accounts for 75% of the national market in terms of sales. DEORSA and DEOCSA represent between them 20% of sales, serving predominantly rural clients with small individual consumption levels.

3. Price setting

- 1.15 Prices are based on the costs of the various elements in the energy production chain. In the generation segment, energy dispatch is made by AMM in accordance with costs declared (but auditable) by generators, and by the price declared by traders in the case of the interconnection with El Salvador. The resultant marginal dispatch cost establishes the “spot” market price. Firm energy provided by generators is remunerated under a rule established in the LGE that all distributors, traders and large users should have a power contract that enables them to cover their firm demand requirements. In relation to electricity importation, supply from El Salvador is not counted as firm energy.

- 1.16 Figure I-1 shows the system supply curve for a typical period,² according to effective capacity in the different plants and their variable production costs. Under this ranking, the following generation blocks can be identified with their respective costs: an initial block of 181MW, consisting of hydroelectric facilities with zero marginal cost (typically run-of-the-river plants) and the geo-thermal plant at Zunil; a second block providing 45MW which has costs on the order of US\$22/MWh, and internal combustion engines that are dispatched with plant factors in excess of 90%; block 3, with costs on the order of US\$25 to US\$31/MWh, including the hydroelectric facilities at Chixoy (275MW) and Jurún Marinala (60MW), which jointly generate 80% of the system's hydroelectric energy (this third block also encompasses two additional plants with a total capacity of 358MW); block 4, with costs between US\$45 and US\$50/MWh consisting of steam/coal thermal plants and internal combustion engines; this block provides a capacity of around 150MW, mostly from the San José steam/coal power plant (120MW), which is dispatched with a plant factor in excess of 80%; block 5, with costs ranging from US\$53 to US\$64/MWh; this block provides about 320MW capacity, of which approximately 240MW corresponds to the Enron internal combustion plants (Puerto Quetzal Power and Poliwatt), which are dispatched at plant factors of 68% and 42% respectively; and block 6, with costs of over US\$70/MWh; this includes a large number of units with capacities in the 10MW to 30MW range, and covers all turbo-gas units operating with light fuel.



² In this case corresponding to the week of 2-8 March 2003.

- 1.17 In the transmission segment, prices depend on the type of power line in question. In Guatemala these belong either to the main system or the secondary system. The main system is used by all system generators, while the secondary transmission system conceptually has functions that benefit a specific agent or group of agents. Components of the main and secondary transport systems are remunerated in accordance with Commercial Coordination Norm 9 (NCC 9).³ This stipulates that for the primary transmission system, the annual cost is calculated as the sum of its annual component costs, distributed among generators in proportion to the amount of firm energy contracted. In the secondary transmission system, costs are calculated in a similar fashion, but distributed only among generators, importers, exporters, and traders that use the asset in the dominant direction of energy flow.
- 1.18 Transmission costs are recovered through user charges and a connection fee. The connection fee compensates the transporter for installing, operating and maintaining the equipment needed to connect a generator or a large user, and for transforming the energy voltage if necessary. Transmission charges are calculated every two years. The AMM calculates installation and construction costs for the various system components on the basis of quotes from binational and international suppliers. The annual transmission cost (ATC) is calculated for each element, assuming a 30-year useful life for the assets and 10% for the cost of capital, the replacement cost of these assets as new, and maximum annual operating and maintenance costs equivalent to 3% of the investment cost. The ATC thus calculated by the AMM is reviewed and approved by the CNEE.
- 1.19 An international power line can be defined as part of the main transmission system or part of the secondary system. Guatemala can also define an international line as a component developed under the risk planning framework, as contemplated in the general design of the regional electricity market (MER). In the first two cases, payment for line use is calculated as indicated for national lines in paragraphs 1.17 and 1.18 and the classification is decided by CNEE following consultation with the AMM. In the third case, approval is needed from the Regional Electric Power Interconnection Commission (CRIE), and the investment is recovered by charging variable transmission fees plus user charges.
- 1.20 For the interconnection project, the most viable alternative is considered to be to charge for the line under Guatemalan regulations, given that MER provisions are currently in the implementation stage, so this route could cause delays in processing the necessary authorizations. Meanwhile, the decision as to whether the line will be part of the main or secondary system, and its charges, will be defined by the CNEE before coming into operation.
- 1.21 In the distribution segment, the CNEE approves each distributor's tariff structure in terms of distribution value added (DVA). The General Electricity Act (LGE),

³ AMM Resolution 157-06, of 30 October 2000.

specifies how the CNEE should calculate the DVA, which includes investment, operation and maintenance costs related to the end user. The investment component of the DVA is calculated assuming a useful life of the asset of 30 years and a real market rate of return between 7% and 13%. The CNEE also calculates indicators determining the efficiency levels to be assumed when calculating the DVA in two or three typical distribution areas selected for their load density (which varies according to whether they are urban or rural areas). The CNEE can also require a productivity factor to be included that reduces the DVA for a five-year period. Based on these calculations, the CNEE publishes electricity charges for end users and each distributor on an annual basis, with the AMM supplying the CNEE with projections of energy and power costs over the following 12 months for this purpose. Power costs are taken directly from contracts with the distributor, and energy prices are calculated as a weighted average of prices projected for the coming 12 months, plus the cost of excess capacity contracted over and above the projected level. These prices are corrected every three months, and distribution rates are recalculated every five years, unless automatic adjustments made by the CNEE attain 300% of their initial value for the period. Every five years, distributors will contract a consulting firm to conduct the study to calculate the DVA. The CNEE will prequalify potential firms and supervise the work. It is worth noting that in order to offset higher oil prices, the government intervened in the electric power market by creating a social tariff, applicable to customers that consume under 300kWh.

4. Market dynamic

- 1.22 The commercial operation of the system in Guatemala involves three types of market: (i) the market for contracts made between different agents, including generators, traders and distributors; (ii) the “spot” market involving short-term transactions related to system dispatch; and (iii) the power deviations market.
- 1.23 The contracts market is agreed freely between the parties; contracts include the following categories: (i) contracts for differences with a load curve, where the generator undertakes to supply an energy demand, defined in terms of an hourly demand curve, throughout the period of the contract, and there is no obligation for a producer to supply the energy committed in the contract from internally generated sources; (ii) power contracts without associated energy, in which the generator and consumer commit a given amount of power and trade energy on the spot market; (iii) power contracts with associated energy, which establish the power contracted and an option exercise price; if the spot market price is below the exercise price, the buyer obtains energy from the spot market; otherwise, it will be supplied from the contract up to the agreed capacity at the exercise price; (iv) contracts for differences arising from lack of demand, in which the producer delivers energy demanded by the buyer that is not supplied by other contracts, at the agreed price up to the committed power level; and (v) power reserve contracts, where a generator's

available capacity is committed as reserve to be called upon by another generator under certain circumstances, such as shortage in the wholesale market.

- 1.24 Demand is divided into off-peak (10:00 p.m. to 6:00 a.m.), mid-peak (6:00 a.m. to 6:00 p.m.) and peak demand (6:00 p.m. to 10:00 p.m.). Dispatch can be characterized in very general terms as follows: (i) in off-peak hours, the load is supplied primarily by run-of-the-river hydroelectric plants, generation based on steam units (coal, sugar mill), geothermal plants, combustion engines of block 2, and, as a marginal power plant, internal combustion units from block 5, completed with reservoir-based hydro plants; this is reflected in spot market energy prices of around US\$42/MWh; (ii) in periods of medium demand, daily regulation hydroelectric power plants come into operation, along with additional internal combustion units from block 5 and, eventually, the higher- cost power plants of block 6; the price in the spot market rises to between US\$50 and US\$60/MWh; and (iii) in peak demand hours, high-cost power plants enter into operation and the spot market price rises above US\$60/MWh.

C. The electricity sector in Mexico

1. Institutional setting

- 1.25 In Mexico the State is responsible for supplying electricity demand through public bodies—the CFE and Luz y Fuerza del Centro (LFC)—which operate as monopolies in their respective markets, supervised by the Ministry of Energy (SENER). In 1992, the legal framework was reformed to allow private participation, and the Energy Regulation Commission (CRE) was created.
- 1.26 In accordance with national energy policy, SENER issues rules governing the public electricity supply service, which must be complied with and observed by the CFE and all entities involved in the production process. SENER also authorizes programs which the CFE submits for its approval. Nonetheless, all technical aspects related to electricity generation, transmission and distribution are the exclusive responsibility of the CFE.
- 1.27 The law empowers CRE to establish ground rules governing the relations between electricity generation and importation concession holders and the firms that provide the public service. This overcomes legal impediments to private investment in generation and external trade, while maintaining the vertically integrated structure, central planning, public ownership of the National Electricity System (SEN), and the exclusive prerogative of the CFE to purchase surplus generation and provide the service to users. Since then, the sector has combined public monopoly with a number of private participation mechanisms, allowing the private sector to produce independently through PPAs signed with the CFE, together with co-generation, self-supply, export and import, and small-scale production.

- 1.28 Operation of the system is carried out by the National Energy Control Center (CENACE), which, as part of the CFE, is responsible for planning the operation, dispatching energy under minimum cost criteria, executing the operation in real-time, supervising the safety of the electric power system and providing post-dispatch services.

2. Structure of the electric power sector in Mexico

- 1.29 The Mexican market exceeds 36,260MW power capacity, with annual energy production above 216,160GWh. Installed capacity in 2001 amounted to 42.4GW. During the last decade, nationwide electricity demand grew by an average of 5% per year. Generation in Mexico is based mainly on hydrocarbons (66%), followed by hydroelectric (23%), coal (6%), nuclear (3%), and geothermal and wind-farm energy (2%). The main consumers are industry (60%) and the residential sector (23%). Effective generation capacity in the private sector (in relation to the 2001 national total of 42.4GW) is about 10% for independent production, 5.3% for self-supply, and 2.7% for co-generation.⁴
- 1.30 The country is divided into five regions (northwest, northeast, center-west, center and south-southeast). For the purposes of interconnection with Guatemala, the south-southeast region (encompassing the states of Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz and Yucatán), are especially important—particularly Chiapas where the interconnection would be physically located. The south-southeast region holds the country's largest electric power generation capacity, totaling 14,131MW in 2001. Of this, 5,854MW corresponds to hydroelectric plants, of which 3,900MW is located in Chiapas. This region also has the second largest concentration of combined-cycle power plants (1,643MW) after the northeast region and the Laguna Verde nuclear plant, which has a capacity of 1,365MW. These power plants are located in the states of Veracruz and Yucatán. Although the south-southeast region accounts for 37.6% of the country's generation capacity, it only has a 13% share in total sales. As a result it offers three very favorable characteristics for the interconnection project with Guatemala: (i) there is production potential for export without the need to invest in additional transmission projects; (ii) its status as a surplus zone with regard to demand in Mexico is favorable for supplying the export market through the interconnection; and (iii) given the concentration of production, marginal costs at generation nodes in the south-southeast region (particularly in Chiapas) tend to be relatively low, since in conditions of limited transmission from that zone to the national capital, there will be surplus energy available.
- 1.31 Mexico has an electric power transport network totaling approximately 80,000 km in length, which creates major potential for regional electricity exchange. International electric power transactions are also carried out on the borders with the

⁴ *Electric Power Sector Prospects 2002-2011*, Ministry of Energy, p.43.

United States and Belize. The Baja California Norte system in Mexico is permanently interconnected with the systems in the western United States (at 230kV), and Belize is permanently interconnected with the Mexican system (at 115kV). There are also another 10 connections along the border with the United States for the purpose of mutual emergency support.

3. Price setting and market dynamic

- 1.32 The Ministry of Finance and Public Credit (SHCP) sets electricity rates, including adjustments and restructuring, based on proposals from the CFE, in which SENER and the Ministry of Trade and Industrial Development also have input.
- 1.33 Final tariffs are set on criteria reflecting the economic cost of generation, transmission and distribution of electric power, including that generated by the CFE and what it obtains from third parties; account is also taken of electricity infrastructure expansion needs. Rates are adjusted in line with the behavior of costs over time, considering the generation, transmission and distribution segments separately, along with relevant differences or variations for regional or seasonal factors, changes in productivity or efficiency, and those deriving from system operating conditions during periods of base, intermediate or peak demand. It should be stressed that price setting includes the return that CFE is required to pay to the State for the assets it uses in providing the service. This is determined annually on the basis of an established rate of return for government-controlled entities and the value of the fixed asset as recorded in financial statements.
- 1.34 Generation costs are linked to electric power dispatch, which in turn is subject to the rules of dispatch and operation of the National Electricity System established by CENACE, in accordance with the provisions of the Public Energy Service Act and its regulations. In addition to exercising operational control over the National Electricity System, CENACE also assigns the generation level of generating units, both for itself and for concession holders with which it has agreements for energy purchase, considering power flows in the transmission system. CENACE dispatches CFE and private power plants in ascending order of respective total short-term cost, or proposed price, as appropriate, in order to satisfy demand at each point in time.
- 1.35 For dispatch purposes, the total short-term cost of electric energy corresponds to the unit cost of each plant in a given period of time; this includes the cost of energy used and all variable operation and maintenance costs that the plant incurs in generating energy and transmitting it to the interconnection.
- 1.36 Payments to third parties that supply energy and power to CFE are based on a capacity charge adjusted by an availability factor, and a payment for energy delivered at the interconnection point, depending on the results of the dispatch. Capacity and energy payments reflect fixed and variable costs respectively. These

include costs incurred by the concession holder in generating energy and transmitting it to the interconnection point.

- 1.37 Charges for the transmission service provided by CFE to private clients are calculated on the basis of the costs it incurs in providing the service, with any regional detail it considers relevant. The respective methodology is proposed by the CFE and approved by SENER and CRE. Charges for other transmission-related services are considered separately and agreed through contract. In the process of calculating transmission charges, the CFE considers all technical solutions that make it possible to provide the required service at least cost, including electric energy exchange between different control areas. When it is impossible to provide the transmission service to a buyer with existing CFE installations, the latter can arrange for the necessary infrastructure to be built, with investment cost being shared by agreement between the parties.
- 1.38 At the present time, final tariffs for the public electricity service are sufficient to cover variable costs and partially cover investment costs. The difference is financed by a subsidy. The main beneficiaries of this situation are residential and agricultural users, since the average price they pay only covers 39% and 26% of costs respectively. The price other users pay represents 93% of the cost. For the residential sector, a price discriminant is used in terms of users' consumption and the climate in the locality concerned.

D. The Central American electricity market

- 1.39 In 2001, the Central American isthmus recorded maximum power demand of 4,770MW, and electric energy requirements totaling 26,500GWh. In 2005 maximum power demand is expected to reach 6,400MW with energy requirements rising to 34,800GWh. Given the attractiveness of this market for the construction of large-scale generating plants, and in order to attract private-sector generators under more reasonable prices and operating conditions, the countries decided to promote the SIEPAC project, which, as mentioned above, is part of the PPP. SIEPAC consists of formation of the regional electricity market (MER) and construction of a 1,830 km-long, 230kV trunk power transmission system stretching from Panama to Guatemala. The project is currently under execution, with total investments estimated at US\$320.3 million, of which US\$240 million have financing approved by the Bank; construction work is expected to be finished in 2006.
- 1.40 To provide the necessary regional legal framework for establishing the MER, the seven Central American States approved and ratified the Central American Electricity Market Framework Treaty, which entered into force in January 1999. This treaty opens up national electricity markets to the region as a whole, both in access to electricity transmission and opportunities to trade electric power between participants in the different countries. It also established the Regional Electric Power Interconnection Commission (CRIE) as the regional regulator, with

responsibility for ensuring that the principles of the framework treaty and subsequent regulations are respected by the participants; and the regional operating entity (EOR), which is responsible for operating the interconnections and commercial aspects of the regional market. The regional bodies have now been formally established and began operating in late 2002; they are currently being strengthened institutionally. Lastly, the framework treaty envisages granting a concession for a public or private enterprise, to be known as the network proprietor firm (EPR), to build and operate the SIEPAC; and it empowers each government to appoint a public partner from the electricity sector in that firm. The EPR was established in February 1999, with equal participation from the six public electric-power firms appointed by their respective governments; and in December 2001 the Spanish firm Endesa entered as the seventh partner, with the same rights and obligations as the other six.

- 1.41 In addition to the benefits of integration, the SIEPAC project, together with its institutional and technical environment, gives participating countries opportunities to optimize their electricity markets. For example, the project includes a series of reliability criteria with which the national systems must comply. In developing this, and in the framework of the SIEPAC project, specialized consultants are promoting a plan to reinforce national systems; and once this is available, each country will identify potential financing sources. The Bank has expressed interest in helping countries to develop these reinforcements. Implementation of the Reinforcements Plan in Guatemala will make it possible to overcome limitations identified in the power transmission system (see paragraph 1.12).

E. Consistency with the Bank's strategy for the region and the country

- 1.42 As part of the Puebla-Panama Plan (PPP), the interconnection project is consistent with Bank policies in promoting projects of multinational scope that speed up the regional integration process (OP-702); it is also consistent with the Bank's country strategy, which accords special importance to sustainable economic growth and competitiveness, and prioritizes poverty reduction. The project is also in line with policies to facilitate medium-term financing for intra-regional exports of capital goods and services, in order to promote integration and economic development in the region, and expand and diversify its trade.

F. The Bank's strategy in the Guatemalan electricity sector

- 1.43 The Bank's comprehensive support strategy for the electricity sector was set out in the country paper (document GN-2149-4, August 2001), and aims to help overcome problems that restrict the results of the reform undertaken in Guatemala in terms of making the sector more efficient economically. This problem arises from a sectoral model that is very open and is therefore viewed as having light regulation. Nonetheless, the market that resulted is concentrated and allows cross-ownership, which makes it possible for an agent to abuse dominant power. In addition, there

- are many power purchase agreements (PPAs) at high prices that were signed before the reform. These can be characterized as “stranded costs” and are posing serious challenges for the sustainability of the reform, since they generate cost overruns and obstruct efficient economic operation of the electricity system. Lastly, the average tariff only covers 82% of the economic cost; the corresponding subsidy is paid by INDE through sales of hydroelectric generation to distributors at below economic cost and through cross-subsidies with other regulated users.
- 1.44 To address aspects of the electricity sector reform, the Bank, in consultation with the Ministry of Energy and Mining, included Guatemala as one of the cases in the Study on the Sustainability of Electricity Sector Reforms coordinated by the Bank’s Sustainable Development Department (SDS). This study aimed to identify the main political, institutional, structural and market architecture constraints that hinder achievement of the goals of a better functioning sector, and pose the greatest challenges for sustainability of the reform. Some of the conclusions of the study to reduce the vulnerability of the reform were to: (i) strengthen MEM planning and policymaking functions; (ii) ensure CNEE independence; (iii) rationalize tariff structures; and (iv) expand international interconnection infrastructure to enhance competitiveness.
- 1.45 In keeping with Bank policies (OP-708 and OP-733) and in response to recommendations made in the sustainability study, the Bank is promoting a program that uses various mechanisms of financing and technical cooperation. The Bank’s program includes a Multilateral Investment Fund (MIF) technical cooperation TC-00-03-02-5. This aims to strengthen the CNEE in order to make information more transparent, oversee competition, enhance service quality, and support the institution in carrying out studies to upgrade the tariff methodology. Project GU-0126 also includes an investment loan to support the Rural Electrification Program (PER), together with a technical cooperation loan for MEM strengthening, involving an estimated total investment of US\$113.1 million.
- 1.46 In addition, on 4 December 2002, the Bank’s Board of Executive Directors approved the operation “Capital Expenditures for Electricity Distribution” (GU-0151) prepared by the Private Sector Department (PRI), which finances the DEORSA and DEOCSA Strategic Business Plan (SBP). Supported by this operation, the SBP is independent of investments to be made under the PER; it consists of investments to remedy deterioration of the existing network, expand the service to clients in the existing service area, and give DEORSA and DEOCSA the means to improve service quality and commercial management. The estimated budget for these investments amounts to US\$78.2 million to be executed over a four-year period.
- 1.47 In addition, last December at the Bank’s request, the Global Environmental Facility (GEF) approved a technical cooperation (TC-01-12-13-0) to promote the development of geothermal energy in Guatemala. This operation is in two phases:

the first is a non-reimbursable technical cooperation to prepare a strategy for the most promising projects, develop concessions schemes, provide training for INDE technical staff, and prepare the full project to attract private investment for the development of geothermal plants. The second phase seeks to gain GEF support, under various possible financing modalities, for private-sector development of the geothermal fields that prove most attractive.

- 1.48 The proposed operation (GU-0171) focuses on increasing international interconnection infrastructure as a tool to enhance competition.

G. Lessons learned

- 1.49 Interconnections between electric power systems in different countries raise two critical issues: (i) making sure the transmission line is used for energy exchanges, or otherwise that its mere availability without dispatch generates a positive impact on the market, via lower prices reflecting the potential effect of being dispatched; and (ii) closely related to the previous point, making sure the technical and commercial operation will help to maximize dispatch of the line or its market share.
- 1.50 In the first area, a wealth of experience has been accumulated from the design and implementation of the SIEPAC project. The legal structure created between the countries to promote the project, together with critical regulatory aspects already identified and in the process of implementation, and the fundamental elements defining the commercial structure, have been key elements in designing the interconnection between Guatemala and Mexico, and have been fundamental for the dialog and accords reached between the two countries.
- 1.51 On the second issue, the interconnection constructed between Guatemala and El Salvador in 1986 is an important experience. This line has had relatively little use, because the project was originally envisaged by the countries as contingent infrastructure to supply potential deficits in one or the other system. Accordingly, a single link was constructed. Nonetheless, the reform of electricity markets caused a change in the commercial dynamic, and a single link resulted in a very weak interconnection for carrying firm energy exchanges.
- 1.52 For these reasons, the interconnection project is proposed as technically robust infrastructure (400kV), with suitable coordination mechanisms in all phases of the project. During execution, contact between those responsible for construction in the two countries will make it possible to coordinate technical aspects, such as the procurement of protection and telecommunications equipment which requires significant degrees of compatibility for the interconnection to function properly. Similarly, working in different markets in each country requires a suitable legal structure for the operation and commercialization of the transmission line services; progress in establishing the MER has smoothed the way considerably in this regard.

H. Coordination with other agencies

- 1.53 The Bank and the government, acting through the Puebla-Panama Plan Promotion and Financing Commission, have submitted the project and carried out coordination activities with other agencies, including the World Bank, the Central American Bank for Economic Integration (CABEI), the Japanese Bank for International Cooperation, KFW (Germany) and the Economic Development Cooperation Fund (Korea). In addition, the Mexican and Guatemalan governments have analyzed funding for the project in the framework of the San José Accord.

II. THE PROJECT

A. Project objectives and components

- 2.1 The general objective of the project is to increase energy supply in Guatemala, improve prices and enhance the security and quality of the electricity service. The project's specific objectives are as follows: (i) to interconnect Guatemala's electric power system with that of Mexico; (ii) to interconnect the Mexican system with the Central American Electric Power Interconnection System (SIEPAC), through the interconnection that already exists between Guatemala and the other five Central American countries; and (iii) to establish accords and define rules to permit and promote energy exchange between agents in Mexico and Guatemala, and in other countries through Guatemala. The results of the project will help make an additional 200MW capacity available in the Guatemalan electricity system and improve systemic security and quality. Annex 1 contains a summary of the project's objectives and targets, in line with the operation's logical framework.
- 2.2 The Guatemala-Mexico interconnection involves construction of a 103-km, 400kV electric power transmission line, and expansion of two substations—one in Tapachula (Mexico) and the other in Los Brillantes, Retalhuleu (Guatemala). The total cost of the interconnection is estimated at US\$55.79 million (US\$43.29 million in Guatemala and US\$12.5 million in Mexico). The project is being developed with 400kV power lines in a single circuit in both countries, but the structures envisaged allow for expansion to a double circuit at a future date (see paragraph 4.1). The initial capacity of the interconnection is expected to be 200MW from Mexico to Guatemala and 70MW in the opposite direction. Although the markets of the two countries are not integrated, the aim is for energy and power exchanges to be made wholly within a market framework. For this purpose, a legal structure has been designed to ensure binational coordination during the construction and operation phases. This contains the elements needed to afford legal security and promote commercial energy transactions between the two countries (see paragraphs 2.11 to 2.18).
- 2.3 In Mexico, interconnection requires construction of 32 km of transmission line at 400kV, and execution of civil and electromechanical works to expand the Tapachula substation as needed to connect the new line to the Mexican system. The Mexican part of the project will be financed with resources from the Federal Electricity Commission (CFE). To date, the CFE has secured financing for the works in its approved budget and has acquired all the materials needed for construction of the power line. The interconnection will allow CFE and other Mexican generators to export energy to agents in the Guatemalan market. Generators from Guatemala will also be in a position to supply energy to the CFE. This could also be extended to the rest of Central America through the interconnection existing in Guatemala with SIEPAC.

- 2.4 The Bank operation will support the Guatemala portion of the project, which has been structured in three components as described below.

1. Construction of transmission line (US\$20 million)

- 2.5 This involves construction of a 400kV transmission line approximately 71 km long. It is intended to use seven types of structures⁵ made of galvanized self-supporting steel, vertically arranged with two guard cables. Two ACSR/AS (1113 KCM) conductors will be used per phase, with a mechanical tension of 46.581kN. One guard cable will be of the CGFO type, with a mechanical tension of 16kN, and the other guard cable will be an OPGW with 36 fiberoptic lines for teleprotection and communications. The foundations will be sunk in reinforced concrete, with a right of way 40 metres wide.

2. Upgrading of the Los Brillantes substation (US\$15.07 million)

- 2.6 The Los Brillantes substation will be upgraded to receive the interconnection line, transform the voltage from 400kV to 230kV, and install a reactor bank. Four single-phase autotransformers will be obtained for the voltage transformation; three of these will be active, forming a triple-phase bank, and one will be held in reserve. Each will have specifications of 75MVA and 400/230kV for installation in the Los Brillantes substation. The need for reactors is a requirement defined in the electricity behavior studies, in order to offset the reactive energy in the line. Four power reactors will be obtained and installed in the substation for this purpose, with a capacity of 66.67 MVARs (triple-phase bank 3x16.67 MVARs with 1x16.67 MVARs in reserve).
- 2.7 The upgrading process will also involve expansion of the substation, consisting of installation of 400kV busbars with 400kV bar coupling, since it currently only has 230kV. As part of the expansion, four 400kV bays will be constructed: (i) to receive the interconnection line; (ii) for voltage transformation; (iii) for the reactor bank; and (iv) for the bar coupling. The substation will include installation of breakers, sectionalizers, safeguards, measurement and control systems on the 400kV and 230kV sides, making it possible to connect the transformer bank to the respective 400kV and 230kV bars and the fire prevention system. Gas insulation technology (GIS) is expected to be used, which substantially reduces land requirements for expansion and makes it possible to use the area already available in the substation, thereby reducing environmental impacts and substation costs.

⁵ The seven types of structures are as follows: (i) short suspension spans; (ii) medium suspension spans; (iii) long suspension spans; (iv) deflexion up to 30; (v) deflexion up to 90; (iv) stretching; and (vii) transposition.

3. Supervision (US\$1.99 million)

- 2.8 Given the magnitude and complexity of the project components, it is considered advisable as part of the project to hire two specialized firms to oversee the contracts to be signed by INDE for line construction and substation upgrading. These firms will ensure compliance with works specifications, equipment, assembly, and in general all services required for construction of the line and expansion of the substation. Contracts are also expected to be signed for the external audit and environmental supervision of the project.

B. Cost and financing

- 2.9 Table II-1 provides estimates of total project costs and the proposed financing. The additional resources (local counterpart funding) will be allocated in the INDE budget.

Table II-1
Cost and financing
(US\$ million)

Category	IDB	Local counterpart	Total
1. Transmission line	16.45	3.55	20.00
1.1 Design, civil works and assembly	3.93	0.00	3.93
1.2 Supply of materials	12.24	0.00	12.24
1.3 Environmental mitigation plan	0.28	0.00	0.28
1.4 Rights of way	0.00	1.20	1.20
1.5 Taxes	0.00	2.35	2.35
2. Upgrading of Los Brillantes substation	13.41	1.66	15.07
2.1 Design, civil works and assembly	1.70	0.00	1.70
2.2 Supply of electromechanical equipment	6.58	0.00	6.58
2.3 Supply and assembly of reactors	2.30	0.00	2.30
2.4 225 MVA 400/230kV transformers	2.61	0.00	2.61
2.5 Environmental mitigation plan	0.22	0.00	0.22
2.5 Taxes	0.00	1.66	1.66
3. Supervision	1.74	0.25	1.99
3.1 Works and assembly supervision	1.47	0.18	1.65
3.2 Audit	0.11	0.01	0.12
3.3 Environmental supervision	0.16	0.06	0.22
4. Inspection and supervision fee	0.38	0.00	0.38
5. Contingencies	1.02	0.00	1.02
6. Financial expenses	4.50	0.33	4.83
6.1 Credit fee	0.00	0.33	0.33
6.2 Interest	4.50	0.00	4.50
Project total	37.50	5.79	43.29
	87%	13%	100%

C. Retroactive financing and recognition of expenses

- 2.10 Expenses incurred as from 1 July 2002, prior to project approval, will be recognized and charged against the local counterpart up to US\$250,000. These will cover INDE outlays for preparation of project bidding documents, studies to establish the cadastre of properties along the path of the power line, and contracted management of project rights of way. Recognition of these expenses will be conditional on prior compliance with requirements substantially analogous to those established in the eventual loan contract.

D. Legal structure and commercialization strategy

- 2.11 Based on the analysis of existing regulations and the different viewpoints of sectoral authorities and market participants in the two countries, it was decided to

- promote a strategy for coordinated project execution and commercialization of the interconnection line service. This is based on the design of a juridical structure ensuring the construction and maintenance of the physical line, and facilitating commercial energy exchanges between the two countries' systems. The project team has worked with representatives of the borrower and Mexico to ensure that this juridical structure is set up and in place. The structure designed acts as an interface between the markets and sectoral regulation in the two countries, and the commercial transactions to be carried out through the interconnection.
- 2.12 The juridical structure is legally based on the Tuxtla Dialogue and Consensus Mechanism, which launched the PPP, and on the Energy Cooperation Agreement signed between the two countries on 17 March 1997. The latter is an international treaty with aims that include expansion of cooperation and leveraging of the potential for electric energy complementation between the two countries.
- 2.13 On 20 May 2003 the two countries signed a mutual commitment and coordination agreement in a memorandum of understanding between the MEM of Guatemala and SENER of Mexico, to implement the electric power interconnection project between the two countries. The memorandum of understanding establishes general conditions for the financing, construction, maintenance and operation of the interconnection, and for management and execution of the respective energy transactions. Both countries presented legal reports to the Bank confirming that the memorandum of understanding is valid and binding under their respective laws. This basically agrees the physical scope of the project in the two countries, and coordination of government actions, within their legal competence, to facilitate financing and expeditious implementation of the project. The agreements contained in the memorandum of understanding also form the basis for completing the juridical structure for construction, operation and commercialization, by requiring CFE, INDE, CENACE and the AMM to sign the other three agreements forming part of the legal structure, as described below.
- 2.14 In accordance with the provisions of the memorandum of understanding, CFE and INDE signed: (i) on 10 July 2003, a specific agreement for engineering and construction of the line, including a timetable for studies, design and necessary construction activities, and their respective specifications; and (ii) on 10 July 2003, an agreement for maintenance and operation of the interconnection. Each of these agreements has now entered into force. The interconnection maintenance and operation agreement also includes arrangements for transmission services and payments for the interconnection. The services provided and charged for by INDE are to adhere to the corresponding methodology established in the LGE and its regulations and the rules and regulations established by the CNEE and the AMM. Equally, all transmission services provided and charged for by CFE will comply with the approved tariffs governing the provision of power transmission services in Mexico.

- 2.15 Similarly, in accordance with the memorandum of understanding, a third agreement was signed on 2 June 2003 and has now entered into force. This relates to operation of the interconnection and the management and execution of transactions between the AMM of Guatemala and CFE in Mexico. It sets out general conditions under which the AMM and CENACE will tackle the technical aspects of project operation, the energy dispatch to be transported by the interconnection, settlement of such transactions and mechanisms guaranteeing energy payment and supply.
- 2.16 In terms of energy marketing, there are various alternatives that the agents in Guatemala and Mexico could use in each market. In Mexico, cogenerators, external producers with excess capacity, self-suppliers, and the CFE could export energy to Guatemala. To do so, they could enter into firm energy agreements with other agents in Guatemala or trade on the spot market. In that case, they would have to be established as importers (sellers) with the AMM. These Mexican agents could also trade through third-party generators or brokers established as agents in Guatemala. Similarly, the agents in Guatemala could export energy to Mexico through supplier contracts with the CFE as cogenerators or as manufacturers requiring the energy supply for their own consumption. Once the SIEPAC project becomes operational, the options for marketing the energy conveyed through the interconnection will eventually be expanded to other agents in the countries that belong to the MER, to import or export energy to or from Mexico, using the interconnections in Guatemala with the other Central American countries.
- 2.17 As can be seen, there are many different alternatives for marketing allowed under the legislation and regulations in the two countries. The decision on which to select will depend on the perspective of the respective agent and its business strategy. However, in order to maximize use of the interconnection, the countries agree in the memorandum of understanding to establish a working group with the following objectives in a framework of equity and reciprocity to: (i) identify possible obstacles to free exchange of electric power; (ii) identify potential barriers to broad utilization of the infrastructure to be built; (iii) remove obstacles that remain within its field of competence as quickly as possible; and (iv) submit the problem identified to the competent authorities in each country for solution. Establishment and implementation of this working group will be a condition precedent to the initial loan disbursement.
- 2.18 To summarize, the strategy for project construction and commercialization of power line services is based on a legal structure, consisting of a memorandum of understanding and three agreements deriving from it. The structure is complemented by the establishment of a binational working group set up to promote maximum utilization of the line. It is important to note that the specific commitments contained in the memorandum of understanding and those agreed in the three agreements deriving therefrom, are legally valid and binding under the laws of the two countries, since they are based on a current international treaty.

Figure II-1 schematically shows the juridical structure and the function of each of its elements.

Figure II-1

Mexico-Guatemala Energy Cooperation Agreement		Tuxtla Dialog and Consensus Mechanism – PPP	
Memorandum of understanding between SENER and MEM establishing general conditions (construction, maintenance, operation and commercial exploitation)			
CFE-INDE Agreement (Construction)	CFE-INDE Agreement (Maintenance of the interconnection)	AMM-CFE Agreement (CENACE) (Operation and commercial transactions)	Binational working group (Promotion of commercial use)
Guatemala-Mexico Interconnection Project			

III. PROJECT EXECUTION

A. Borrower, guarantor and executing agency

- 3.1 The borrower will be the Republic of Guatemala, with INDE as the executing agency acting through ETCEE. The government will channel loan resources to INDE as an earmarked transfer for implementation of the interconnection. Presentation of the subsidiary agreements signed between the borrower and INDE for transfer of the loan funds, and the obligations corresponding to the latter as project executing agency, will be a condition precedent to the initial disbursement.

B. Project execution and management

- 3.2 In order to execute the project properly, the executing agency, through ETCEE, has set up a group within its organization to coordinate activities, both within ETCEE and with external organizations involved in project execution and supervision. The following main processes have been identified, which will be supported by the current ETCEE structure and the coordination group mentioned above: (i) preparation of disbursement requests and their presentation to the Bank; (ii) maintenance of a suitable accounting system in accordance with the requirements set out in clause 7.01 of the General Conditions, and an internal oversight system; (iii) presentation of semiannual financial reports and consolidated annual financial statements for the project; (iv) preparation of bidding documents; (v) coordination with other INDE dependencies; (vi) coordination of project-related activities with the CFE in Mexico; (vii) hiring of consulting services for specialized project tasks; (viii) monitoring of work done by firms hired to supervise civil and electromechanical work; (ix) control and monitoring of execution programs; (x) coordination of activities relating to management of rights of way and the environment; (xi) preparation of the technical reports required by the Bank; and (xii) review and processing of work estimates.

C. Goods and services procurement

- 3.3 The project timetable has been prepared in coordination with the CFE and seeks above all to comply with the scheduled date for entry into operation, and particularly fulfillment of the agreements contained in the memorandum of understanding signed on 20 May 2003 between SENER and MEM. As a result of this, INDE has requested Bank authorization for advance hiring before the loan is approved, in order to start pre-qualification processes for construction of the line, upgrading the substation and works supervision. INDE will adhere to IDB procurement procedures and policies to ensure that this advance contracting is acceptable to the Bank.

- 3.4 Although INDE is making swift progress in acquiring rights of way, it is still necessary to start bidding processes before all rights of way are obtained, in order to fulfill commitments with Mexico and ensure that the benefits of the project materialize rapidly. In accordance with this timetable, and that relating to the construction work on the transmission line, as mentioned above, INDE expects to start the civil works as soon as all rights of way have been acquired.
- 3.5 Accordingly, it is proposed that prior to obtaining all the rights of way needed for the project, the executing agency may convene the international competitive bidding process for the project's civil works, on the clear understanding that a condition precedent to signing the contract with the successful bidder requires the executing agency to present proof to the Bank that it holds legal ownership, rights of way and other rights over the land through which the project works will pass, as necessary to start the construction. In addition, the bidding documents will clearly and explicitly stipulate: (i) that contract signing will be subject to the executing agency having acquired the necessary rights of way for the project, as established above; (ii) the maximum time that can elapse between the date of contract award and its signing, and the adjustment system to be used once the above-mentioned period has elapsed; and (iii) that the bid maintenance guarantee will cover the entire maximum period referred to in the previous point.
- 3.6 In view of the complexity involved in coordinating the civil works, assembly and equipment procurement (transformers, reactors, fiberoptic cable, etc.), turnkey contracts will be used for both the power line and the substation.
- 3.7 INDE has requested a waiver from the Bank to allow direct purchase, by reference to brand and model, of telecommunications protection, measurement and SCADA equipment to be installed in the Los Brillantes substation, in its expansion to 400kV for the Guatemala-Mexico electricity interconnection. This is necessary for technical reasons to ensure that the equipment installed in the Los Brillantes substation is compatible with that existing in the Mexican system. The waiver will produce benefits for the project and avoid potential operating problems in the interconnection that could restrict its use and undermine its reliability. The cost of the equipment is estimated at US\$250,000. The specific equipment for which the waiver is requested is as follows:
- a. Communication: (i) SDH ABB FOX 515 communication access node; (ii) ABB NSD570 digital equipment for telecommunications protection; (iii) ALCOA FUJIKURA single mode fiberoptic cable; (iv) Siemens ESB 2000i power line carrier system; (v) Siemens SWT 2000 F6 teleprotection tone equipment; (vi) Haefely Trench wave traps; (vii) Siemens AKE 100 A3 coupling unit; (viii) Siemens AKE 100 A4 hybrid coupling unit.

b. Protection equipment: as described in the following table.

Function	Identification	Brand and model
Main protection 1	85L	SEL-421
Main protection 2	21/21N	SEL-321
Back-up protection	67 N	SEL-351
Breaker failure protection	50 FI	SEL-352
Reclosing relay	79	SEL-279

c. SCADA control equipment: GENERAL ELECTRIC HARRIS D 200 remote station.

3.8 Civil works contracting, selection and contracting for consulting services, and goods procurement financed with the loan will be conducted in accordance with the relevant Bank procedures and policies. International competitive bidding (ICB) will be required for civil works contracts whose estimated value exceeds US\$1.5 million, for consulting services in excess of US\$200,000, and for goods procurement in amounts above US\$250,000. Procurements and contracting for civil works and services in amounts below these limits will be governed in principle by local legislation, always paying attention to economy, efficiency, and reasonability of prices, and allowing participation by suppliers from Bank member countries. Annex II presents the project tendering and procurement plan, summarizing the limits stated above.

D. Execution period and disbursement timetable

3.9 Project execution and disbursement will take place over a four-year period, counted from the date on which the loan contract enters into force. Under no circumstances may disbursements be completed in less than three years. Table III-1 gives the estimated disbursement timetable.

Table III-1
Disbursement timetable
(US\$ million equivalent)

Source	Year 1	Year 2	Year 3	Year 4	Total
IDB (OC)	0.81	16.94	13.25	6.50	37.50
INDE counterpart	0.13	2.60	2.05	1.01	5.79
Total	0.94	19.54	15.30	7.51	43.29

E. Monitoring and evaluation

1. Bank supervision

- 3.10 Project supervision will be carried out by the Bank's Country Office in Guatemala. In addition, at least one meeting for project management and monitoring will be held annually with participation from the project team.
- 3.11 No later than 30 September each year during project execution, joint meetings with the borrower, the executing agency and the Bank will be held to analyze progress in project implementation and in the annual investment plan. Compliance with targets, objectives and indicators will be reviewed, and the investment plan for the following year will be agreed, specifying targets to be achieved and any corrective measures needed. At least 15 working days before these annual meetings, the executing agency will submit a report to the Ministry of Finance and the Bank on the last six months, prepared by supervisors contracted for the power line and substation together with a project progress report, a report on compliance with contractual obligations and progress in achieving project indicators and targets as set out in Annex I (Logical Framework). Should the Bank discover failings in project execution, the executing agency will submit to the Bank a proposal for corrective measures with their respective implementation timetable, progress on which will be reviewed during subsequent management and monitoring missions.

2. External audit

- 3.12 Within 120 days following the close of each fiscal year during project execution, the executing agency will send the Bank financial statements for the project in Guatemala, certified by a firm of independent auditors acceptable to the Bank and in accordance with its requirements on this issue. It will also submit a technical audit each year certifying the physical progress of the civil works. This will be financed out of loan proceeds.
- 3.13 Bank procedures for bidding by audit firms will be used to select and hire the auditors. It is recommended that the auditors be contracted for a minimum of four years, subject to a termination clause in the event of unsatisfactory performance. The same firm will be responsible for certifying the financial statements and the technical audit.

3. Ex post evaluation

- 3.14 The borrower and the Bank consider it worthwhile conducting an ex post evaluation of the project, bearing in mind factors such as market operation of the line, structural differences between the markets in the two countries, technical characteristics of the interconnection, competition in execution with the SIEPAC project and the legal structure for this project. For the same reasons, the view is that this evaluation should be carried out five years after the line comes into operation.

The Bank will perform the evaluation, and INDE will support the process of data collection and monitoring under terms indicated below.

- 3.15 The evaluation will measure the behavior of the following variables at least: (i) cost differentials in the energy transmitted; (ii) the degree of utilization of the line; (iii) substitution of new generation; and (iv) the improvement in service quality. The target by the end of 2006 for cost differentials in the energy transmitted through the line will be at least US\$7.5/MWh (with utilization factors in excess of 60%) or greater than US\$10/MWh (with utilization factors of at least 45%); these differentials should be sustained until the end of 2008. The baseline indicator will be the average daily cost observed during the year before the link comes into operation, as reported annually by the AMM. The target for the line utilization factor by the end of 2006 will be at least 45% (with cost differentials greater than US\$10/MWh), or at least 60% (with cost differentials of at least US\$7.5/MWh), to be sustained until the end of 2008; the baseline indicator for this variable will be 0% of line use. The utilization factor will be reported on a monthly basis and consolidated each year by ETCEE. The utilization factor for the line will be measured against a baseline figure of 200 MW for Mexico-to-Guatemala and 70 MW for Guatemala-to-Mexico.
- 3.16 The substitution of new generation will be valued in terms of the average economic costs of investment in new thermal generation capacity. This requires annual cost monitoring during the line construction stage and in the five years following its entry into operation. To provide a suitable data source, a representative sample will be taken of projects concluding each year in Latin American countries. At least US\$1.25 million of savings per year on investments in new generation is expected to have been obtained by the end of 2009, as a result of firm energy supply at 50MW through the line. INDE will collect the local information from annual AMM reports and forward it to the Bank.
- 3.17 Lastly, to measure service quality, once the project becomes operational, deviations from maximum frequency in the Guatemala system will be reduced to 0.1 Hz. The baseline figure will be 0.15 Hz and the source of data will be frequency measurement reports by the Dispatch Center. Based on the data, the hourly average during peak demand will be calculated on randomly selected dates over a two-month measurement period, with a sample of no less than 50 readings.

IV. VIABILITY AND RISKS

A. Technical and economic viability

- 4.1 To define the specifications of the power line, INDE received technical support from CFE, which has considerable experience in this area. The choice of a 400kV interconnection, with single-circuit power cables and potential for expansion to two circuits, was made for technical reasons relating to system stability. Lower voltages would be unviable since this is an interconnection line between two systems of very different sizes (7,000MW on the Central American side compared to 42,000MW in Mexico). A lower voltage link would be too weak to maintain synchronism; oscillations in the flow of energy through the line would trigger protection devices and the project would suffer frequent outages incompatible with the standards required in the system. Infrastructure also needs to be installed for two circuits to guarantee the possibility of expansion and reduce the vulnerability of the link when the 200MW and 70MW capacity levels are exceeded in each direction.
- 4.2 Economically the line is justified, among other things, by savings arising from substitution and quality improvements (stability and frequency regulation). The economic evaluation shows that the line is viable, yielding an internal rate of return of 34% in the baseline case and a net present value of US\$107 million.
- 4.3 The economic evaluation was prepared from the standpoint of the two countries, assuming that a second circuit will be installed 10 years after startup of operations and that marketing the energy conveyed does not require any additional modifications in the existing transmission system in Guatemala. In addition, the evaluation sought to quantify benefits arising from cost differences between the systems. Short-term benefits can be expected from the substitution of generation by existing power plants in Guatemala; in the medium and long-term there is the possibility of firm energy supply.
- 4.4 **In the short term.** According to data on resource and dispatch costs, energy from Guatemala can be replaced by energy generated in Mexico, depending on the level of demand at different times of day, as follows:
 - (i) **Hours of off-peak demand:** the aim will be to use Mexican energy at a cost of US\$26/MWh. Although the energy price in the spot market is on the order of US\$50/MWh (see paragraph 1.24), substitutable energy at this price is relatively scarce; it would be confined, for example, to one internal combustion unit (18MW). Nonetheless, depending on dispatch constraints, it is possible to conceive of partial substitution for coal-based generation (US\$44/MWh); substitution of 20% of that energy would be equivalent to some 25MW during the six hours of off-peak demand.

- (ii) **Hours of medium demand.** Potential substitution increases significantly during the medium demand period: internal combustion engines with costs on the order of US\$50-US\$52/MWh and supplying over 200MW, could be replaced by imported energy at a cost of US\$28/MWh. Depending on network constraints, one could envision at least 90% utilization of the interconnection capacity during these hours.
- (iii) **Hours of peak demand.** The potential for benefits increases further during the peak demand period, with substitution of over 50MW from units in block 6 (see paragraph 1.16), in addition to partial substitution of internal combustion engines (which would still be needed to satisfy peak demand); the economic benefit would arise from substitution of energy costing on the order of US\$60-US\$70/MWh by energy costing US\$30/MWh. Table IV-1 summarizes this approximation to the potential short-term benefits.

Table IV-1
Summary of benefits arising from energy substitution

	Off-peak demand (8hr/day)	Medium demand (12 hr/day)	Peak demand (4hr/day)	Averages
Potential substitution	43MW	180MW	200MW	3,304MWh (138MW) - utilization factor 69%
	(344MWh)	(2,160MWh)	(800MWh)	
Potential benefit	US\$14-US\$20/MWh monthly average ≈ US\$16/MWh	US\$20/MWh	US\$30/MWh	Average US\$22/MWh

- 4.5 **In the long term.** The capacity of the interconnection line has been estimated at 200MW given transmission constraints in the Guatemalan system—but not because of limitations in the line as such, whose real capacity could be greater. With a link of this magnitude, there should be long-term benefits from firm energy, where apart from lower generation costs, benefits would be also achieved through reduced investment costs.
- 4.6 The magnitude of the benefits arising from capacity savings is calculated by comparing investment costs in the two countries. In the Mexican case, as mentioned above, capacity costs are reduced through: (a) the possibility of developing large power plants using natural gas (instead of liquid fuels); this reduces pollution control costs as well as operating and maintenance expenses; and (b) the scale effect, which is particularly important in baseline power plants. A reasonable

estimate of the economies of scale deriving from the possibility of supplying demand from Mexico through firm capacity could be on the order of US\$200 per kilowatt installed. This is equivalent to about US\$25/kW-year.

- 4.7 According to MEM projections, maximum demand is set to grow by about 700MW between 2002 and 2010. A conservative assumption would predict firm supply at 50MW three years after the interconnection operation begins (US\$1.25 million/year), rising to 100MW when the second circuit comes into service (US\$2.5 million/year).
- 4.8 To perform the sensitivity analysis on the evaluation, the following possible scenarios were identified, reflecting the project risks discussed below: (i) lower benefits resulting from a narrowing of energy cost differentials between Mexico and Guatemala; (ii) limited energy transfers resulting from potential technical restrictions in the Guatemalan production and transmission system; (iii) failure to obtain benefits relating to firm transfers; and (iv) a potential increase in investment costs.
- (i) **Lower benefits resulting from a smaller cost differential.** This risk would arise from a tendency for production costs to equalize between the two systems, either because the cost of production has been undervalued in Mexico or because it has been overvalued in Guatemala. It may also occur when market conditions allow generators from one country or another to increase the amount of rent-taking to maximize revenue. To quantify the risk, an attempt was made to calculate the value of the minimum average cost differential between Mexico and Guatemala that would still provide an acceptable IRR for the project (holding other parameters at their base values). It was found that the average differential could fall from US\$22/MWh (baseline case) to US\$6.5/MWh, in which case the IRR would shrink to 13%.
 - (ii) **Smaller benefits arising from limited transfers.** This risk could occur if situations occurred in which the technical characteristics of generation (minimum generation in steam plants, for example) did not allow certain transactions on the spot market. The consequence would be a lower rate of utilization of the line capacity. To evaluate this risk, an attempt was made to find the minimum utilization factor that would generate an acceptable IRR for the project. It was found that the line utilization factor could fall from 69% to 21%, maintaining other parameters at their baseline values, and still produce an IRR of 13%.
 - (iii) **Simultaneous reductions in the cost differential and transfer volume.** When the cost differential is reduced, imported energy becomes less competitive in relation to the energy to be replaced. A situation could therefore arise where the cost margin and the volume of

energy transfers decline simultaneously. In this case, the cost differential needs to be in a range between US\$7.5 and US\$10/MWh, and average transfers need to be on the order of 45% to 60% of the exchange capacity (90MW to 120MW), which is highly likely to be achieved.

- (iv) **Non-materialization of firm energy transactions.** This situation would occur if firm energy deliveries from Mexico fail to materialize. In this case, the IRR only falls from 34% to 33%, which confirms the preponderance of benefits associated with energy substitution.
- (v) **Higher investment costs.** To quantify this effect, a 10% increase in total project cost was assumed, which lowers the project's IRR to 32%.

4.9 The economic analysis gives very robust values in terms of project feasibility, suggesting that the potential risks are unlikely to undermine its viability, measured in terms of IRR. The following table summarizes the results obtained for the different cases.

Summary of results		
	IRR	NPV (US\$ million)
Baseline case	34%	107
Cost differential of US\$0.0065/MWh	13%	0
Utilization factor 21%	13%	0
Without firm transactions	34%	100
Cost increases 10%	32%	56

Note: A discount rate of 13% was used to calculate the NPV.

4.10 Lastly, it should be noted that the quantitative evaluation cannot assess certain major project benefits for Guatemalans, such as the impact of better integration with the region and a more competitive market, thanks to penetration of the electric power market by a major new player. However, the dynamic behavior of the market in which the line will operate cannot be predicted, nor its impact on the distribution of benefits due to substitution between the two countries. The latter will depend on the relative development of the markets and the negotiating power of the agents in the two countries.

B. Institutional and financial viability

4.11 Although the borrower will be the Republic of Guatemala, with INDE acting as executing agency, loan repayment will be a government responsibility. Analysis of the organizational structure of INDE and the financial area demonstrates the entity's financial and institutional viability to manage the loan proceeds.

- 4.12 The loan proceeds will be channeled for exclusive use for the project (see paragraph 3.1). ETCEE will hold functional responsibility for project execution, and has a good track record in the construction and operation of existing transmissions lines (230 kV, 138 kV and 69 kV).
- 4.13 Current regulations in Guatemala for the payment of transmission lines establish an appropriate framework for line costs to be covered by connection fees and user charges (see paragraphs 1.17 to 1.20). Since the costs used to calculate these items will be those actually incurred to provide the service, in the case of the interconnection, all the additional investments to be made to eventually install a second circuit—estimated at 11% of the total project cost—are not likely to be taken into account.
- 4.14 CNEE classification of the line as primary or secondary, based on AMM recommendations, will have various implications in the cost recovery process. If the line is classified as part of the primary system, the line costs will be paid by all the generators. The payment by each generator will be calculated proportionately to the power contracted, independently of interconnection use. These payments will be applied to all the INDE assets and will be recalculated every two years. If the line is classified as part of the secondary system, only the agents transporting the electric power through it will pay for the line, proportionately to the power. In this case, payment will depend on use of the line, and the amount to be paid by each agent will be calculated based on capacity, here approximately 200 MW, establishing a unit cost per MW. The amount charged to the agent is to be paid monthly based on the unit price and the transactions conducted using the interconnection.
- 4.15 Classification as a secondary system line may generate more volatility in collections, compared with the regulatory option of classifying the line as part of the primary system. However, this situation will be mitigated by the high likelihood of the line being intensely used (see paragraphs 4.2-4.9) and the project financing structure. It is important to note in this connection that the amount of the loan will be a capital contribution by the government to INDE, thereby substantially reducing the impact of any volatility in collections on INDE finances. The government contribution is also consistent with other project benefits that cannot be reflected in the regulations, such as revenue investments, including its contribution to regional integration, increased competitiveness of the electric power sector in Guatemala, improved quality and reliability of the electric power system in Guatemala, and the strategic importance for INDE of making preliminary marginal investments in preparing the line so that it can eventually receive a second circuit, especially taking into account the growing problems to procure rights of way and reduce adverse environmental impact.
- 4.16 If the interconnection line is used at the projected levels, given the capital contribution by the government, there will be a positive impact on finances for both ETCEE and for INDE at the corporate level. However, the above notwithstanding,

in the context of Bank project preparation and execution, especially for technical cooperation projects (see paragraphs 1.44-1.47), the sector dialogue with the country must be continued, with a horizon beyond the current administration, in order to ensure that the activities identified under these projects help resolve the constraints described with respect to PPAs and low-income rates (see 1.43). This is important because the cost overruns resulting from the situation have been absorbed by the INDE power generation utility. However, since there is a cash management unit, the situation also has an impact on the transmission business, limiting investment capacity. The dialogue should also consider a review of institutional options that could help resolve the above-described situation, including a more complete separation between generation, distribution and transmission, through sector regulations.

C. Project environmental and social management proposal

- 4.17 Electric power transmission works can cause significant environmental and social impacts. In addition to complying with Bank policies, the project's environmental and social aspects satisfy national rules on environmental protection and improvement. As required by current regulations on projects to construct electric power transmission lines at voltages above 230kV, an Environmental and Social Impact Study (EIAS) was carried out, enabling the project team to prepare the corresponding Strategic Environmental Assessment (SEA). This identified potential environmental and social impacts, both direct and indirect, in addition to potential environmental liabilities. It also evaluated the institutional framework for upgrading environmental and social management, defining activities and methodology directly related to the management and mitigation of those impacts, and specifying a suitable execution scheme for the project's environmental and social management. As a result of the SEA, and drawing on lessons learned from the executed part of loan GU-0126 (Rural Electrification Program—PER), a Social and Environmental Management Plan (PGAS) has been prepared. The project thus includes environmental and social variables at all stages the project cycle, from programming through evaluation.
- 4.18 *The project's environmental and social impacts.* To ensure the project's environmental and social viability, INDE and the project team prepared a strategy that includes performing an Environmental and Social Impact Study (EIAS), and complying with procedures for obtaining an environmental permit in the country. In addition, as a major innovation, financing was provided to prepare and execute a mass promotion and publicity campaign on the benefits of the investment program along the path of the power line. The EIAS included a detailed identification of the direct and indirect impacts of the civil works, together with their characterization and valuation; identification, description and economic assessment of preventive and mitigation measures; environmental liabilities; institutional implementation and supervision mechanism; environmental audit plan, etc. The EIAS was performed during the preparation phase of the operation and made public on 4 March 2003.

The promotion and publicity campaign (based on participatory social workshops) is currently being carried out. These aspects are described in detail in the PGAS.

- 4.19 In general, the technologies and techniques made available through appropriate engineering designs for the construction, operation and maintenance of transmission lines and substations, make it possible to avoid, mitigate or offset negative impacts. The EIAS has identified potential direct and indirect social and environmental impacts that could occur during the construction, operation and maintenance stages; the program includes appropriate mitigation measures (relating to logging, noise caused by machinery use, generation of solid and liquid waste during the construction and installation of equipment, clearing the path of the line, measures for populated residential or commercial areas, cultural or archaeological resources in the path of the line, etc.). The EIAS also confirmed that the project does not require involuntary resettlement. Formulation of the project was based among other things on an environmental and social study carried out in 1993, when the line had been considered with a voltage of 230kV. This work was updated and adapted in the new EIAS under new project conditions and with prior knowledge of the zone. Accordingly, preliminary design criteria have been included that take account of social and environmental variables (design of a path for the line that is socially and environmentally appropriate, consideration of vulnerability to natural disasters, etc.).
- 4.20 The provisional path of the line incorporates these variables, having eliminated an alternative shorter and sloping path which impacted an archaeological site. In addition, the use of gas insulation technology (GIS)⁶ has been envisaged for the substations, which substantially reduces land requirements for expansion and makes it possible to use the area already available in the substations, thereby reducing environmental and social impacts. In the PGAS, special attention was paid to prevention, mitigation or compensation of impacts caused by the line and its access roads during the operation stage; a sustainable action plan was also prepared to minimize impacts during the operational phase, especially from access roads. The environmental specifications and measures contained in the environmental management plans will be included in bidding documents and contracts for construction, operation and maintenance of the power line. Independent environmental supervision will also be hired.
- 4.21 The benefits of the Guatemala-Mexico interconnection include lower energy prices and greater installed capacity, which among other things increases the potential to carry out social electrification projects, makes the current Guatemalan electricity system safer and helps to ensure that the benefits have a regional impact in the medium-term. Social electrification projects contribute to local economic development among the affected populations, and they create capacity for better

⁶ GIS stands for gas isolation substations; this technology is an alternative to oil isolation, which requires a larger installation area.

opportunities in areas such as education or health by providing a stable electricity system. A downward trend in electricity prices makes the electric power system more sustainable, reduces fiscal requirements for the sector and opens up new spaces for social investment.

- 4.22 *Institutional environmental framework.* The Constitution of Guatemala, enacted on 31 May 1985, defines responsibilities in relation to the environment and ecological equilibrium. Decree 90-2000 established the Ministry of the Environment and Natural Resources (MARN) as the sector's governing body, absorbing the former National Environmental Commission (CONAMA), which had been created in the Environmental Protection and Improvement Act (Decree 68-86). The Ministry of the Environment and Natural Resources (MARN) was created in 2001 with responsibility for environmental management throughout the country, and the development of regulations for this purpose. In addition, MARN also develops environmental impact assessment procedures and issues environmental permits. In the areas of MEM jurisdiction related to EIAS, the MEM Environmental Unit (UA) provides technical advice to the MARN Environmental Management Department (Dirección General de Gestión Ambiental), providing opinions to enable the Environmental Management Department to issue the corresponding resolution in accordance with Decree 68-86, reformed by 1-93. This has its legal basis in the Interinstitutional Coordination and Corporation Agreement signed between CONAMA and MEM in September 1998, creating the Ministerial Environmental Unit. INDE is the institution responsible for complying with and enforcing the requirements of authorizations and the EIAS, and for holding consultations and, possibly, negotiations with communities, including indigenous ones.
- 4.23 In addition, the strategy reaffirms institutional actions agreed with the authorities during preparation of the Rural Electrification Program (GU-0126), which established the need for the Environmental Unit (UA) to be formalized as an MEM budgetary unit, thereby giving it permanent legal status and sufficient and stable budgetary resources to fulfill its functions. For that purpose, the UA has been included in the MEM programmatic categories network, with approval from the Technical Office of the Budget (DTP) attached to the Ministry of Public Finance (MFP). This was achieved with actions agreed for operation GU-0126, including: (i) an agreement between MARN, MEM and INDE; and (ii) MFP approval of the organizational structure and administrative budget for the functioning of the MEM Environmental Unit during 2003. Lastly, it is worth noting that the PGAS is consistent with the environmental and social strategy proposed for PRI operation GU-0151, which is financing the business plan of DEORSA and DEOCSA (the country's electricity distribution firms).
- 4.24 The new MEM-MARN-INDE agreement signed in the framework of program GU-0126 will be used as part of the PGAS. This agreement establishes cooperation mechanisms within the attributions of each of the institutions involved, to formulate

and jointly execute environmental policies; and to streamline and facilitate administrative procedures for social and environmental assessments and/or environmental and social impact studies, along with control mechanisms and compliance with environmental protection measures.

D. Development benefits and impacts

- 4.25 The benefits of the Guatemala-Mexico interconnection include greater competition, lower energy costs and an increase in available capacity. Among other things, this will increase the potential to carry out social electrification projects in the future, make the current Guatemalan electric power system more secure, and help ensure that the benefits have regional impact in the medium-term. Social electrification projects contribute to local economic development among the affected populations, and they create capacity for better opportunities in areas such as education or health by providing a stable electric power system. The interconnection also allows new players to enter the market, thereby increasing competition and reducing potential domination by incumbents and control of the regulatory agency by the regulated industry. A downward trend in electric power costs improves the sustainability of the electricity system, reduces fiscal requirements for the sector and opens up new spaces for social investment. In addition, by tying Guatemala into a relatively large system, transmission frequency will suffer fewer fluctuations, so users will enjoy a better quality service. In addition to benefiting residential users, this also generates productivity improvements among commercial and industrial customers that use specialized electrical equipment.
- 4.26 The operation does not qualify as a poverty-targeted investment (PTI) or as a social-equity enhancing project (SEQ). However, by promoting competitiveness, the program will generate potential benefits in terms of creating jobs and increasing income.

E. Risks

- 4.27 There are a number of specific situations that could affect outcomes and impacts during the course of the project. In the case of outcomes, the main risks are as follows: (i) potential situations arising inside each country that could delay the project during the construction phase; and (ii) considering that the interconnection would be the first 400 kV power line in Guatemala, there is scant operational and technical experience in INDE to execute and operate a project for transmission at this voltage. Coordination problems in construction and maintenance could raise costs or delay the project coming on line. Lack of experience in INDE with this type of project could lead to cost overruns or technical problems during the operation of the link.
- 4.28 With regard to impacts, the greatest risk would result from the interconnection being underused in the operating stage. Coordination or communication problems

between the two countries could restrict the amount of energy carried by the interconnection, thereby affecting its economic viability; and periods of shortages in the Mexican or Guatemala markets could lower the priority of energy dispatch for export to either country.

- 4.29 To mitigate potential coordination and communication risks, the authorities and the Bank held intensive consultations with project stakeholders in the early stages of preparation, including the sector's lead institutions and market regulators (MEM, AMM and CNEE), public- and private-sector generators, distribution firms and energy traders. The Bank also promoted the same level of consultations between the Mexican counterpart and the equivalent stakeholders in that country. Lastly, INDE, supported by environmental consultants, has been carrying out a wide-ranging process of communication and consultation with the community. Based on the information obtained from consultations and the specifics of the project, a legally binding juridical structure has been designed, based on a memorandum of understanding signed between the two countries and on binational agreements. This makes it possible to ensure execution and commercial operation of the interconnection (paragraphs 2.11 through 2.18). The prior consultation work has also been a major facilitator in building consensus around the project in the two countries.
- 4.30 The lack of experience in INDE with 400kV transmission lines has been overcome through permanent technical support from the CFE, in carrying out electrical studies, designing the line and preparing bidding documents, which are at an advanced stage of preparation. In addition, independent works supervisors will be hired as part of the operation to ensure compliance with the documents. During the operation, this risk will be mitigated through the coordination between INDE and the CFE established under the operation and maintenance agreement.

GUATEMALA-MEXICO ELECTRICITY INTERCONNECTION PROJECT (GU-0171)
LOGICAL FRAMEWORK

[illegible]

GUATEMALA-MEXICO ELECTRICITY INTERCONNECTION PROJECT (GU-0171)

TENDERING AND PROCUREMENT PLAN

	Amount US\$ (thousands)	IDB %	Local %	Method	Prequalification	SPN publication date
Civil works construction						
Design, construction, assembly, testing and implementation of 400kV transmission line (1)	18,800	88	12	ICB	Yes	2003
Design, manufacture, equipment supply, assembly, testing and implementation to upgrade Los Brillantes substation to 400kV (1)	14,820	89	11	ICB	Yes	2003
Goods procurement						
Communications, protection and control equipment for Los Brillantes substation	250,000	89	11	DP	No	N/A
Consulting services				ICB		
Supervision of transmission line	908	89	11	ICB	Yes	2003
Supervision of Los Brillantes substation expansion	742	89	11	ICB	Yes	2003
Technical and financial statements audit	120	92	8	ICB	Yes	2003
Environmental oversight	220	73	27	ICB	Yes	2003

ICB = International competitive bidding

DP = Direct purchase

(1) Turnkey contracts

Limits on procurement for goods and consulting services (US\$ equivalent)

	Civil works	Goods	Consulting services
International competitive bidding (ICB)	Above US\$1,500,000	\$250,000 and above	Above US\$200,000
Local competitive bidding (LCB)		US\$50,000 through US\$249,999	US\$50,000 through US\$199,999
Private tender, shopping, or short list		Below US\$50,000	Below US\$50,000

Figures refer to U.S. dollar equivalents at the date of each budget.